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# Molluscs from Baffin Bay and the Northern North Atlantic Ocean

**Arthur H. Clarke**

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Arthur H. Clarke

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**Résumé**

En 1961, 1970 et 1971, on a fait 48 pêches, principalement dans des milieux archibenthiques et abyssaux de la baie de Baffin et de l'Atlantique nord entre Terre-Neuve et l'Islande. Les prises comptent 174 espèces de mollusques dont plusieurs sont nouvelles et certaines autres rarement collectionnées. L'analyse des spécimens révèle des extensions de répartitions importantes et certaines caractéristiques des populations:

1 on observe entre le Groenland et l'Islande une frontière faunique euro-américaine septentrionale;

2 les faunes archibenthiques et abyssales de la baie de Baffin se différencient de celles de la mer du Labrador de manière à s'accorder avec l'âge généralement attribué à la baie de Baffin;

3 la zoogéographie des mollusques abyssaux et archibenthiques de l'Atlantique nord paraît dynamique et non pas statique. L'auteur expose la taxonomie et la zoogéographie de plusieurs espèces. Il en décrit deux considérées nouvelles, la ***Melanella orphanensis*** et la ***Limatula louiseae***.

**Summary**

Forty-eight hauls, principally from archibenthal and abyssal depths, were taken in Baffin Bay and in the North Atlantic between Newfoundland and Iceland in 1961, 1970 and 1971. The collections contain 174 species of molluscs, including several that represent new species, rarely collected species, or substantial range extensions. Analysis of the material indicates that:

1 a North American–European faunal boundary exists between Greenland and Iceland;

2 the archibenthal and abyssal fauna of Baffin Bay have differentiated from the Labrador Sea fauna to an extent that is in agreement with the presumed age of Baffin Bay; and

3 the zoogeography of North Atlantic archibenthal and abyssal molluscs appears to be dynamic and not static. The taxonomy and zoogeography of several species is discussed. ***Melanella orphanensis*** and ***Limatula louiseae*** are described as new.

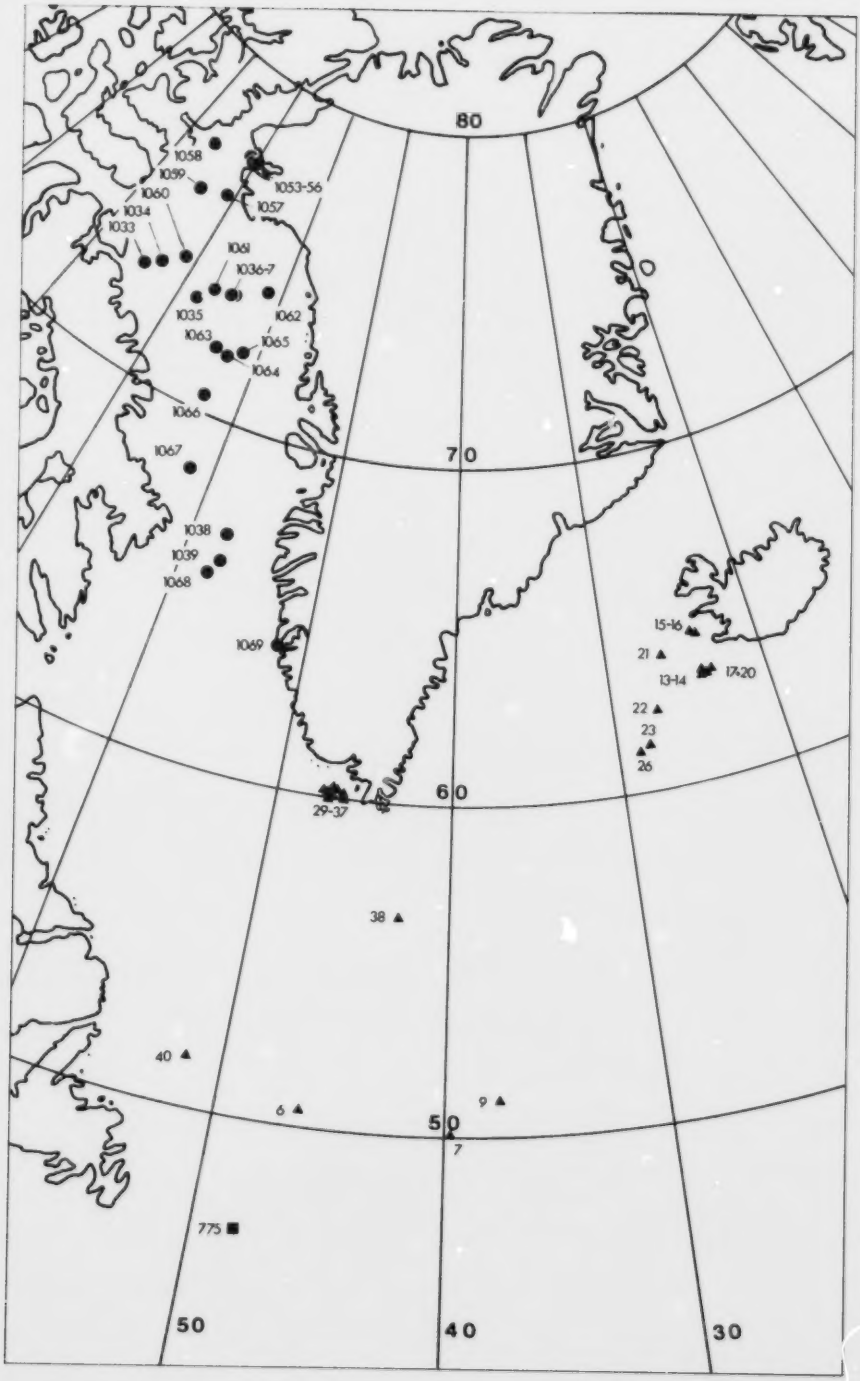
## Biographical Note

Arthur H. Clarke, Head of the Invertebrate Zoology Section and Curator of Molluscs at the National Museum of Natural Sciences, National Museums of Canada, was born in 1926 in Danvers, Massachusetts. He received his M.Sc. from Cornell University in 1958 for work on freshwater molluscs and his Ph.D. from Harvard University in 1960 for research on deep-sea marine molluscs. From 1957 to 1959, Dr. Clarke worked as a marine biologist for Columbia University, and in 1959 he joined the staff of the National Museums of Canada. He has published approximately 80 scientific papers, dealing principally with the taxonomy, distribution, and ecology of North American marine and freshwater molluscs.

Dr. Clarke is past-president (1968–69) of the American Malacological Union and is currently editor of AMU publications. He is also associate editor of the scientific journals *Malacologia* and *The Nautilus*. In 1971 he was appointed Adjunct Professor of Biology at Carleton University. His current projects include research on the molluscs of Canada and training Canadian students in malacology and related fields.

**Acknowledgements**

The author is grateful to the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, for ship time and use of facilities aboard C.S.S. *Dawson* and C.S.S. *Hudson,* to the United States Naval Oceanographic Office, Washington, D.C., for similar support aboard U.S.S. *Lynch*, and to the Museum of Natural History, Smithsonian Institution, for access to their complete and well-managed collection of molluscs. Mr. G. Leonard Johnson, Chief Scientist on board U.S.S. *Lynch,* and to the Museum of Natural History, Smithsonian material for this study. I also thank Mr. Brian T. Kidd for excellent and extensive assistance in the field; Mrs. Muriel F. I. Smith, Mrs. Jane Topping and Miss Patricia Solowan for dedicated assistance in the laboratory; and Mr. Stanley W. Gorham for collection of material off the Grand Banks. Outstanding artistic support was provided by Miss Aleta Karstad, who prepared the fine specimen drawings, and Mr. Charles Douglas, who prepared the map. Discussions with colleagues, particularly Dr. Robert C. Bullock, Dr. Edward L. Bousfield, Dr. Roy D. Hyndman, Dr. Charlotte E. Keen, Dr. Michael Rex and Dr. David I. Ross, were also useful. Any errors, of course, are mine alone.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## Introduction

Several opportunities have arisen during the past few years to carry out archibenthal and abyssal dredging in Baffin Bay and the northwestern North Atlantic Ocean. The principal area of interest was the deep basin of Baffin Bay, a region that contains a poorly known and partly endemic fauna. It was hoped that further study of the fauna might contribute not only to a fuller understanding of its composition and probable origin, but also provide information of significance to the history of plate tectonics in the region. Of course, comparative data from adjacent regions were necessary, and therefore dredgings were carried out in the Labrador and Greenland seas; previously collected material was also studied.

The molluscan fauna collected is of unusual interest. A total of 174 species was found, and several represent new species, rarely collected species, or substantial range extensions. Analysis of the results shows that the species occurrences may contribute not only to the history of geological events in Baffin Bay, but also to a fuller understanding of the boundaries of major zoogeographic regions in the northern North Atlantic Ocean. The discovery of some well-known species far beyond their previously known geographic limits also provides evidence that geographical distributions of some archibenthal molluscs may change significantly in a few decades. This casts doubt on the present accuracy of composite distribution patterns deduced from museum collections that have been assembled throughout the past 100 years.

These questions and others are considered in some detail in the following sections. A preliminary discussion has also been published recently (Clarke 1973).

## Materials and Methods

Most of the specimens were collected during three separate cruises in 1970 and 1971. From 7 to 22 September 1970, Mr. Brian Kidd and I travelled in Baffin Bay on board C.S.S. *Dawson*, an oceanographic ship operated by the Bedford Institute of Oceanography, Dartmouth, Nova Scotia. Seven dredge hauls were taken using a modified Menzies Dredge. Between 23 May and 4 June 1971, Mr. Kidd was on board U.S.S. *Lynch* between Argentia, Newfoundland, and Reykjavik, Iceland. The U.S.S. *Lynch* is an oceanographic vessel operated by the United States Naval Oceanographic Office, Washington, D.C. Nine dredge hauls were made using an Arctic Dredge (Clarke 1972), or a standard rock dredge modified by insertion of a wire-mesh screen liner. After the *Lynch* left Iceland to return to Newfoundland, dredging was continued by Scientist-in-Charge G. Leonard Johnson. The modified rock dredge was used, and an additional 26 dredge hauls were made.

From 17 September to 10 October 1971, I carried out another series of dredgings in Baffin Bay, this time aboard the Bedford Institute's famous oceanographic vessel C.S.S. *Hudson*. The Arctic Dredge was used, and twelve archibenthal and abyssal dredge hauls were taken with it. Five shallow dredge hauls were also made near Thule and Godthaab, Greenland, using a modified Agassiz Dredge, and shore collecting was also done at Thule.

I also studied material collected on previous expeditions. One dredge haul in 775 fathoms near the Grand Banks of Newfoundland is of special interest. That haul was made by Mr. Stanley W. Gorham in 1961 from the *A.T. Cameron*, a Fisheries Research Board of Canada vessel, using a modified Agassiz Dredge. The original station number (15½) has been changed to 775 in the table station data and elsewhere. Specimens collected by Dr. Howard Hume of Dalhousie University, Nova Scotia, during core sampling for sediment studies in Baffin Bay were also useful. These collections and others are referred to in the text.

Station data are summarized in Tables 1 and 2, and the mollusc species collected are listed in Table 3.

Map 1
Research area, showing dredging stations.
● C.S.S. *Dawson* and C.S.S. *Hudson* stations
▲ U.S.S. *Lynch* stations
■ *A. T. Cameron* station

Table 1
Basic station data

| Sta. No. | Lat. N. | Long. W. | Region | Depth (fm) (uncorrected) | Gear[1] | Date |
|---|---|---|---|---|---|---|
| | | | U.S.S. *Lynch*, 1971 | | | |
| 6 | 50°32.9′ | 46°22.0′ | Labrador Sea | 958 | A | May 23 |
| 7 | 50°13.5′ | 39°59.5′ | Labrador Sea | 2354 | A | May 24 |
| 9 | 51°06.6′ | 37°47.3′ | Labrador Sea | 1918 | A | May 29 |
| 13 | 63°04.7′ | 24°02.8′ | Iceland Shelf | 240 | A | June 4 |
| 14 | 63°06.7′ | 24°00.0′ | Iceland Shelf | 220 | A | June 4 |
| 15 | 64°37.7′ | 23°58.3′ | Iceland Shelf | 58 | R | June |
| 16 | 64°27.8′ | 24°23.1′ | Iceland Shelf | 86 | R | June |
| 17 | 63°38.6′ | 23°24.4′ | Iceland Shelf | 37 | R | June |
| 20 | 63°17.6′ | 24°13.5′ | Iceland Shelf | 55 | R | June |
| 21 | 63°56.8′ | 26°51.4′ | Iceland Shelf | 320 | R | June |
| 22 | 62°30.5′ | 27°22.8′ | Greenland Sea | 650 | R | June |
| 23 | 61°36.6′ | 28°25.7′ | Greenland Sea | 600–700 | R | June |
| 26 | 61°22.6′ | 28°43.9′ | Greenland Sea | 620–740 | R | June |
| 29 | 59°57.8′ | 46°35.4′ | Greenland Shelf | 260–320 | R | June |
| 30 | 60°03.7′ | 46°49.5′ | Greenland Shelf | 800–950 | R | June |
| 31 | 60°04.6′ | 46°50.6′ | Greenland Shelf | 660–700 | R | June |
| 32 | 60°04.8′ | 46°44.0′ | Greenland Shelf | 550–650 | R | June |
| 33 | 60°01.9′ | 46°41.1′ | Greenland Shelf | 380–460 | R | June |
| 35 | 60°07.1′ | 47°01.7′ | Greenland Shelf | 405–490 | R | June |
| 36 | 60°08.6′ | 47°06.5′ | Greenland Shelf | 220–400 | R | June |
| 37 | 60°04.6′ | 47°10.5′ | Greenland Shelf | 480–650 | R | June |
| 38 | 56°38.5′ | 42°54.2′ | Labrador Sea | 1810 | R | June |
| 40 | 51°27.5′ | 51°42.2′ | Labrador Sea | 215 | R | June |
| | | | *A.T. Cameron*, 1961 | | | |
| 775 | 45°30′ | 48°17′ | off Grand Banks | 775 | S | Sept. 17 |
| | | | C.S.S. *Dawson*, 1970 | | | |
| 1033 | 73°19.4′ | 73°02.5′ | Baffin Bay | 509 | M | Sept. 9 |
| 1034 | 73°00.7′ | 74°34.3′ | Baffin Bay | 489 | M | Sept. 10 |
| 1035 | 73°13.4′ | 67°57.3′ | Baffin Bay | 1220 | M | Sept. 11 |
| 1036 | 73°30.24′ | 65°33.24′ | Baffin Bay | 1268 | M | Sept. 11 |
| 1037 | 73°29.9′ | 64°33.9′ | Baffin Bay | 1027 | M | Sept. 11 |
| 1038 | 67°07.5′ | 57°57.9′ | Baffin Bay | 447 | M | Sept. 14 |
| 1039 | 66°10.5′ | 57°33.6′ | Davis Strait | 314 | M | Sept. 14 |
| | | | C.S.S. *Hudson*, 1971 | | | |
| 1052 | 76°34′ | 68°50′ | Thule | beach | | Sept. 17 |
| 1053 | 76°34′ | 68°50′ | Thule | 92 | S | Sept. 18 |
| 1054 | 76°34′ | 68°50′ | Thule | 25 | S | Sept. 18 |
| 1055 | 76°34′ | 68°50′ | Thule | 85–115 | S | Sept. 19 |
| 1056 | 76°34′ | 68°50′ | Thule | 95–110 | S | Sept. 19 |
| 1057 | 76°00.8′ | 71°19.4′ | Baffin Bay | 260 | A | Sept. 20 |
| 1058 | 77°12.7′ | 75°31.4′ | Baffin Bay | 312 | A | Sept. 23 |
| 1059 | 75°50.7′ | 74°17.4′ | Baffin Bay | 208 | A | Sept. 26 |
| 1060 | 74°06.4′ | 71°27.8′ | Baffin Bay | 600 | A | Sept. 27 |
| 1061 | 73°25.8′ | 66°55.3′ | Baffin Bay | 1280 | A | Sept. 29 |
| 1062 | 74°13′ | 62°09′ | Baffin Bay | 360 | A | Sept. 29 |
| 1063 | 72°15′ | 63°47′ | Baffin Bay | 1237 | A | Sept. 30 |
| 1064 | 71°56.8′ | 62°46.8′ | Baffin Bay | 1202 | A | Oct. 1 |

| Sta. No. | Lat. N. | Long. W. | Region | Depth (fm) (uncorrected) | Gear[1] | Date |
|---|---|---|---|---|---|---|
| 1065 | 72°08.8′ | 61°38.0′ | Baffin Bay | 1000 | A | Oct. 1 |
| 1066 | 70°31.0′ to 70°31.4′ | 63°16.3′ to 63°17.3′ | Baffin Bay | 1150 | A | Oct. 2 |
| 1067 | 68°28.3′ to 68°29.1′ | 61°59.6′ to 62°02.8′ | Baffin Bay | 975 | A | Oct. 4 |
| 1068 | 65°46.5′ | 57°52.6′ | Davis Strait | 295 | A | Oct. 7 |
| 1069 | 64°10′ | 51°43.3′ | Godthaab | 30 | S | Oct. 10 |

1. A Arctic Dredge
M Menzies Dredge
R rock dredge
S small biological dredge (Agassiz Dredge)

Table 2
Sediment data

| Sta. No. | Particle size distribution: per cent within size classes (mm) | | | | | | | | | | | Dominant particle size classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2.0–1.0 | 1.0–0.5 | 0.5–0.25 | 0.25–0.12 | 0.12–0.063 | 0.063–0.032 | 0.032–0.016 | 0.016–0.008 | 0.008–0.004 | 0.004–0.002 | <.002 | |
| 7 | .72 | .23 | 2.17 | 9.49 | 6.11 | 9.34 | 14.99 | 9.08 | 12.08 | 8.30 | 27.49 | silt, clay |
| 9 | 1.22 | .50 | 7.06 | 17.94 | 7.47 | 4.48 | 5.46 | 4.37 | 10.76 | 9.81 | 30.93 | silt, clay |
| 13 | 2.06 | 1.15 | 5.47 | 11.90 | 10.95 | 15.39 | 18.14 | 10.79 | 5.73 | 3.89 | 14.54 | silt, clay |
| 14 | 7.43 | 7.96 | 16.73 | 21.58 | 12.66 | 12.45 | 7.78 | 4.00 | 1.76 | 1.49 | 6.16 | silt, sand |
| 1034 | .16 | .32 | .32 | .32 | .32 | 1.93 | 7.90 | 9.36 | 12.90 | 14.48 | 52.01 | clay, silt |
| 1035 | .85 | .73 | 1.07 | 1.35 | 1.13 | .62 | 2.87 | 5.32 | 6.91 | 15.29 | 63.88 | clay, silt |
| 1036 | 6.48 | 6.38 | 3.46 | 2.03 | .95 | 1.75 | 2.49 | 4.27 | 7.76 | 12.27 | 52.27 | clay, silt sand |
| 1037 | 3.25 | 3.10 | 3.02 | 3.18 | 2.06 | 4.14 | 1.08 | 4.92 | 10.60 | 13.65 | 51.01 | clay, silt |
| 1039 | 20.83 | 8.26 | 8.85 | 33.58 | 10.77 | 8.09 | 1.85 | 1.39 | 1.21 | 1.24 | 3.93 | silt, sand |
| 1057 | 4.14 | 5.84 | 9.41 | 11.35 | 8.13 | 7.68 | 5.33 | 6.68 | 6.99 | 8.17 | 26.27 | silt, clay |
| 1060 | 1.90 | .62 | .87 | .96 | .52 | 1.42 | 2.24 | 5.60 | 11.61 | 14.36 | 59.89 | clay, silt |
| 1061 | .60 | .49 | .85 | .92 | .57 | .77 | 1.59 | 4.36 | 10.26 | 18.25 | 61.35 | clay, silt |
| 1062 | .43 | .73 | 1.06 | 4.91 | 5.72 | 6.09 | 3.13 | 3.97 | 7.01 | 11.38 | 55.78 | clay, silt |
| 1064 | 1.73 | .58 | .74 | .91 | .48 | .83 | 1.54 | 3.72 | 12.33 | 17.86 | 59.28 | clay, silt |
| 1065 | 1.94 | 1.52 | 1.58 | 1.66 | .90 | 1.05 | 1.49 | 4.13 | 11.95 | 16.04 | 57.64 | clay, silt |
| 1066 | 1.12 | 1.01 | 1.45 | 1.95 | 1.20 | 2.34 | 2.86 | 4.61 | 9.72 | 16.65 | 57.08 | clay, silt |
| 1067 | .59 | .42 | .63 | .75 | .46 | .86 | 1.97 | 3.78 | 12.56 | 16.02 | 61.96 | clay, silt |
| 1068 | 3.41 | 1.47 | 7.05 | 11.34 | 11.00 | 16.87 | 9.80 | 6.17 | 5.27 | 5.14 | 20.48 | silt, clay |

Table 3
Mollusc species and stations, observed depths, and observed regional distributions[1]

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| **Polyplacophora** | | fm | | | | | |
| Lepidopleuridae | | | | | | | |
| 1. *Lepidopleurus alveolus* (M. Sars) | 6 | 958 | – | † | – | – | – |
| 2. *Lepidopleurus asellus* (Spengler) | 14 | 220 | – | – | – | – | † |
| 3. *Stenosemus albus* (L) | 16 | 86 | – | – | – | – | † |
| 4. *Hanleya hanleyi* (Bean) | 14, 29, 36 | 220–(260) | – | – | † | – | † |
| **Aplacophora** | | | | | | | |
| 5. *Proneomenia* sp. | 1034 | 489 | – | – | – | † | – |
| 6. *Chaetoderma* cf. *nitidulum* Lovén | 1033, 1034 | 489–509 | – | – | – | † | – |
| 7. *Chaetoderma* sp. | 1033, 1058 | 312–509 | – | – | – | † | – |
| **Gastropoda** | | | | | | | |
| Fissurellidae | | | | | | | |
| 8. *Emarginula fissura* (L) | (17) | (37) | – | – | – | – | (†) |
| 9. *Puncturella noachina* (L) | (6), (14), (23), (32), (35), (37), (1039), 1069 | 30–(220)–(958) | – | (†) | † | (†) | (†) |
| Patellidae | | | | | | | |
| 10. *Lepeta caeca* (Müller) | 1054, (1058), (1069) | 25–(30)–(312) | – | – | (†) | † | – |
| 11. *Pilidium fulvum* (Müller) | (32) | (550) | – | – | (†) | – | – |
| Trochidae | | | | | | | |
| 12. *Margarites costalis* (Gould) | 1054 | 25 | – | – | – | † | – |
| 13. *Margarites groenlandicus* (Gmelin) | 1069 | 30 | – | – | † | – | – |
| 14. *Margarites olivaceus* (Brown) | 1054 | 25 | – | – | – | † | – |
| 15. *Margarites umbilicalis* (Brod. & Sby.) | 1054 | 25 | – | – | – | † | – |
| 16. *Margarites vahli* (Møller) | (35), (37), 1033, 1034, 1039 | 314–509 | – | – | (†) | † | – |
| 17. *Lischkeia ottoi* (Philippi) | 775 | 775 | † | – | – | – | – |
| 18. *Solariella obscura* (Couthouy) | (37) | (480) | – | – | (†) | – | – |
| 19. *Solariella varicosa* (Migh. & Ad.) | 40 | 215 | – | † | – | – | – |
| 20. *Calliostoma occidentale* (Migh. & Ad.) | 36 | 220 | – | – | (†) | – | – |
| Seguenziidae | | | | | | | |
| 21. *Seguenzia reticulata* (Philippi) | (23) | (600) | – | – | – | – | (†) |
| Rissoidae | | | | | | | |
| 22. *Cingula arenaria* (Migh. & Ad.) | 1039 | 314 | – | – | – | † | – |
| 23. *Alvania janmayeni* (Friele) | 1033, 1034, 1039 | 314–509 | – | – | – | † | – |
| 24. *Alvania scrobiculata* (Müller) | (1039), (1058) | (312)–(314) | – | – | – | (†) | – |
| 25. *Cithna tenella* (Jeffreys) | 7 | 2354 | – | † | – | – | – |

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| | | fm | | | | | |
| **Cerithiopsidae** | | | | | | | |
| 26. *Cerithiopsis costulata* (Møller) | (1039) | (314) | – | – | – | (†) | – |
| 27. *Cerithiella metula* (Lovén) | 6, (13), (14), (32), 1039 | 314–958 | – | (†) | (†) | (†) | (†) |
| 28. *Laeocochlis granosa* (Wood) | (29), (35), (775), 1039, (1068) | (295)–314–(775) | (†) | – | (†) | † | – |
| **Aporrhaidae** | | | | | | | |
| 29. *Aporrhais occidentalis* (Beck) | (1039) | (314) | – | – | – | (†) | – |
| 30. *Aporrhais serresiana* (Michaud) | (14) | (220) | – | – | – | – | (†) |
| **Trichotropidae** | | | | | | | |
| 31. *Torellia vestita* Jeffreys | 775 | 775 | † | – | – | – | – |
| 32. *Trichotropis borealis* Brod. & Sby. | (14), (1039) | (220)–(314) | – | – | – | (†) | (†) |
| **Naticidae** | | | | | | | |
| 33. *Amauropsis islandica* (Gmelin) | 16 | 86 | – | – | – | – | † |
| 34. *Polinices pallida* (Brod. & Sby.) | (14) | (220) | – | – | – | – | (†) |
| 35. *Natica clausa* Brod. & Sby. | (13), (14), 15, (21), (30), (35), (775), 1058, 1059, 1062 | 58–360–(800) | (†) | – | (†) | † | † |
| **Epitoniidae** | | | | | | | |
| 36. *Acirsa costulata* (Migh. & Ad.) | (6), (13) | (240)–(958) | – | (†) | – | – | (†) |
| 37. *Epitonium obtusicostatum* (G. O. Sars) | (23), (32), (33), (35) | (460)–(600) | – | – | (†) | – | (†) |
| **Aclididae** | | | | | | | |
| 38. *Aclis walleri* Jeffreys | (26) | (620) | – | – | – | – | (†) |
| **Eulimidae** | | | | | | | |
| 39. *Eulima stenostoma* Jeffreys | (13), (14) | (220)–(240) | – | – | – | – | (†) |
| **Muricidae** | | | | | | | |
| 40. *Boreotrophon clathratus* (L) | (13), (32?), (37?) | (240)–(480?) | – | – | (?) | – | (†) |
| 41. *Boreotrophon fabricii* (Beck) | (14?), (1039), (1069) | (30)–(314) | – | – | (†) | (†) | (?) |
| 42. *Boreotrophon truncatus* (Strøm) | (13), (14?) | (220?)–(240) | – | – | – | – | (†) |
| **Columbellidae** | | | | | | | |
| 43. *Pyrene costulata* (Cantraine) | (23) | (600) | – | – | – | – | (†) |
| **Buccinidae** | | | | | | | |
| 44. *Beringius ossiani* (Friele) | (32) | (550) | – | – | (†) | – | – |
| 45. *Volutopsius norvegicus* (Gmelin) | (21), (23), (29) | (320)–(600) | – | – | (†) | – | (†) |
| 46. *Colus glaber* (Verkrüzen) | (21) | (320) | – | – | – | – | (†) |
| 47. *Colus fusiformis* (Thorson) | 16 | 86 | – | – | – | – | † |
| 48. *Colus krampi* (Thorson) | 1036, 1039, 1061, 1065 | 314–1280 | – | – | – | † | – |

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| | | fm | | | | | |
| 49. *Colus latericeus* (Møller) | (32), (775) | (650)–775 | (†) | – | (†) | – | – |
| 50. *Colus tortuosus* (Reeve) | 1058, (1064), (1065) | 312–(1202) | – | – | – | † | – |
| 51. *Colus turgidulus minor* (Thorson) | (32), (35) | (490)–(550) | – | – | (†) | – | – |
| 52. *Colus ventricosus* (Gray) | (775) | (775) | (†) | – | – | – | – |
| 53. *Plicifusus kroyeri* (Møller) | (29) | (260) | – | – | (†) | – | – |
| 54. *Neptunea despecta* (L) | (14), (22), (29), (31), (35) | (220)–(660) | – | – | (†) | – | (†) |
| 55. *Neptunea satura* (Martyn) | 15, (20) | (55)–58 | – | – | – | – | (†) |
| 56. *Buccinum cyaneum* Bruguière | 1054 | 25 | – | – | – | † | – |
| 57. *Buccinum elatior* Tryon (= *B. tenue* Gray, preocc.; see Baily 1961) | (1054) | (25) | – | – | – | (†) | – |
| 58. *Buccinum finmarkianum* Verkrüzen | (1039), 1057 | 260–(314) | – | – | – | † | – |
| 59. *Buccinum hydrophanum* Hancock | 1053, 1054, 1055, 1058, 1059 | 25–312 | – | – | – | † | – |
| 60. *Buccinum sericatum* Hancock | (36) | (220) | – | – | (†) | – | – |
| Nassariidae | | | | | | | |
| 61. *Nassarius incrassatus* (Strøm) | 17, 20 | 37–55 | – | – | – | – | † |
| Cancellariidae | | | | | | | |
| 62. *Admete couthouyi* (Jay) | (13), (14), (40), 1058 | (240)–312 | – | (†) | – | † | (†) |
| Turridae | | | | | | | |
| 63. *Spirotropis carinata* (Philippi) | (13), (14) | (220)–(240) | – | – | – | – | (†) |
| 64. *Oenopota cinerea* (Møller) | 1039 | 314 | – | – | – | † | – |
| 65. *Oenopota declivis* (Lovén) | (13), (14),1033, (1034), 1039, 1057, 1068 | (220)–260–509 | – | – | – | † | (†) |
| 66. *Oenopota* cf. *decussata* (Couthouy) | (6), 14, 1034 | 220–489–(958) | – | (†) | – | † | † |
| 67. *Oenopota* cf. *incisula* (Verrill) | 1057 | 260 | – | – | – | † | – |
| 68. *Oenopota nobilis* (Møller) | 14 | 220 | – | – | – | – | † |
| 69. *Oenopota* cf. *pyramidalis* (Strøm) | (14) | (220) | – | – | – | – | (†) |
| 70. *Oenopota reticulata* (Brown) | (40), 1057, 1058, 1059 | 208–312 | – | (†) | – | † | – |
| 71. *Typhlomangelia nivalis* (Lovén) | (14) | (220) | – | – | – | – | (†) |
| Pyramidellidae | | | | | | | |
| 72. *Eulimella compactilis* Jeffreys | 1039, 1068 | 295–314 | – | – | – | (†) | – |
| 73. ***Melanella orphanensis*** (n. sp.) | (6) | (958) | – | (†) | – | – | – |
| 74. *Pyramidella* sp. | (6) | (958) | – | (†) | – | – | – |
| Scaphandridae | | | | | | | |
| 75. *Cylichna alba* (Brown) | (6), (35), (40), 1039, (1056) | (100)–314–(958) | – | (†) | (†) | † | – |
| 76. *Cylichna cylindracea* Pennant | 1033, 1034, 1035, 1036, 1056, 1058, 1060, 1068 | 100–1268 | – | – | – | † | – |

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| | | fm | | | | | |
| 77. *Cylichna propinqua* M. Sars | 1033, (1057), (1068) | (260)–509 | – | – | – | † | – |
| 78. *Scaphander nobilis* Verrill | (775) | (775) | (†) | – | – | – | – |
| 79. *Scaphander punctostriatus* (Migh. & Ad.) | (6) | (958) | – | (†) | – | – | – |
| Philinidae | | | | | | | |
| 80. *Philene quadrata* Wood | 6 | 958 | – | † | – | – | – |
| Diaphanidae | | | | | | | |
| 81. *Diaphana globosa* Lovén | (6) | (958) | – | (†) | – | – | – |
| 82. *Diaphana hiemalis* Gould | 1068 | 295 | – | – | – | † | – |
| Aeolidiidae | | | | | | | |
| 83. *Aeolidia* sp. | 17 | 37 | – | – | – | – | † |
| **Scaphopoda** | | | | | | | |
| Siphonodentaliidae | | | | | | | |
| 84. *Siphonodentalium lobatum* (Sowerby) | 1033, 1034, (1060), 1062, 1068 | 295–509–(600) | – | – | – | † | – |
| Dentaliidae | | | | | | | |
| 85. *Dentalium agile* M. Sars | (23) | (600) | – | – | – | – | (†) |
| 86. *Dentalium entale* L | 13, 14, 15, 16, 21 | 58–320 | – | – | – | – | † |
| 87. *Dentalium occidentale* Stimpson | (14), 1039, 1068 | (220)–295–314 | – | – | – | † | (†) |
| **Pelecypoda** | | | | | | | |
| Nuculidae | | | | | | | |
| 88. *Nucula atacellana* Schenck (= *N. cancellata* Jeffreys, non Meek) | 6 | 958 | – | † | – | – | – |
| 89. *Nucula belloti* Adams | 1058 | 312 | – | – | – | † | – |
| 90. *Nucula delphinodonta* Migh. & Ad. | 1033, 1034, 1038, 1039, 1057, 1059, 1068 | 208–509 | – | – | – | † | – |
| 91. *Nucula proxima* Say | 40 | 215 | – | † | – | – | – |
| 92. *Nucula tumidula* Malm | 13, 14 | 220–240 | – | – | – | – | † |
| Malletiidae | | | | | | | |
| 93. *Tindaria* sp. | (23) | (600) | – | – | – | – | (†) |
| Nuculanidae | | | | | | | |
| 94. *Pristigloma nitens* (Jeffreys) | 7, 9 | 1918–2354 | – | † | – | – | – |
| 95. *Ledella confinis* (Smith) | (6), (7) | (958)–(2354) | – | (†) | – | – | – |
| 96. *Ledella messanensis* (Seguenza) | 6, 23 | 700–958 | – | † | – | – | † |
| 97. *Nuculana minuta* (Müller) | (16), 1053, 1054, 1056 | 25–95 | – | – | – | † | (†) |
| 98. *Nuculana pernula pernula* (Müller) | (775) | (775) | (†) | – | – | – | – |

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| | | fm | | | | | |
| 99. *Nuculana pernula costigera* (Leche) | 1056, (1059) | 100–(208) | – | – | – | † | – |
| 100. *Nuculana* sp. (juv.) | (40) | (215) | – | (†) | – | – | – |
| 101. *Yoldiella expansa* (Jeffreys) | (1034) | (489) | – | – | – | (†) | – |
| 102. *Yoldiella intermedia* (M. Sars) | (40), 1033, 1034, 1039, 1057, 1058, 1059, 1060, 1062 | 208–600 | – | (†) | – | † | – |
| 103. *Yoldiella iris* Verrill & Bush | 1034 | 489 | – | – | – | † | – |
| 104. *Yoldiella lenticula* (Møller) | 1062 | 360 | – | – | – | † | – |
| 105. *Yoldiella lucida* (Lovén) | 6, 13, 14 | 220–958 | – | † | – | – | † |
| 106. *Yoldiella* sp. (juv.) | (23) | (600) | – | – | – | – | (†) |
| 107. *Megayoldia thraciaeformis* (Storer) | 1057, 1058, (1059) | (208)–260–312 | – | – | – | † | – |
| Arcidae | | | | | | | |
| 108. *Bathyarca glacialis* (Gray) | 40, 1033, 1034, 1039, 1054, 1057, 1062, 1068 | 25–509 | – | (†) | – | † | – |
| 109. *Bathyarca "pectunculoides"* (Scacchi) | (13), 14, (23), (26), (32), (35), (37), 1035, 1036, 1061, 1064 | 220–1280 | – | – | (†) | † | † |
| 110. *Bathyarca profundicola* Verrill | 9 | 1918 | – | † | – | – | – |
| 111. *Arca nodulosa* Müller | 21, 36 | 320 | – | – | (†) | – | † |
| Limopsidae | | | | | | | |
| 112. *Limopsis cristata* Jeffreys | (13), (14) | (220)–(240) | – | – | – | – | (†) |
| 113. *Limopsis minuta* Philippi | 6, 13, (23), (26), (32), (35), 775 | 240–958 | (†) | † | (†) | – | † |
| Mytilidae | | | | | | | |
| 114. *Dacrydium vitreum* (Møller) | 6, 1039, 1057, 1058, 1062 | 260–958 | – | † | – | † | – |
| 115. *Modiolus phaseolinus* (Philippi) | 16, 17, 20 | 37–86 | – | – | – | – | † |
| 116. *Musculus discors laevigata* (Gray) | 1053, 1054, 1056, 1069 | 25–95 | – | – | † | † | – |
| 117. *Musculus nigra* (Gray) | 1056 | 95 | – | – | – | † | – |
| Pectinidae | | | | | | | |
| 118. *Cyclopecten abyssorum* (Lovén) | 1039 | 314 | – | – | – | (†) | – |
| 119. *Cyclopecten groenlandicum* (Sowerby) | (13), (14), 1034, 1038, 1062 | (220)–360–489 | – | – | – | † | (†) |
| 120. *Cyclopecten imbriferum* (Lovén) | (23), (26), (35), 1062, (1038), (1068) | (295)–360–(620) | – | – | (†) | † | (†) |
| 121. *Cyclopecten vitreum* (Gmelin) | 775 | 775 | † | – | – | – | – |
| 122. *Chlamys furtiva* (Lovén) | (14) | (220) | – | – | – | – | (†) |
| 123. *Chlamys islandicus* (Müller) | (29), (36), (1054), (1069) | (25)–(260) | – | – | (†) | (†) | – |
| 124. *Chlamys septemradiatus* (Müller) | (13), (14), (21), (23), (29) | (220)–(600) | – | – | (†) | – | (†) |

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| | | fm | | | | | |
| 125. *Chlamys striatus* (Müller) | (20) | (55) | – | – | – | – | (†) |
| 126. *Hinnites distorta* (da Costa) | 17, (20) | 37–(55) | – | – | – | – | † |
| Limidae | | | | | | | |
| 127. *Limatula elliptica* Jeffreys | (35) | (405) | – | – | (†) | – | – |
| 128. *Limatula hyperborea* (Jensen) | 6, 13, (23), 1039, 1068 | 240–958 | – | † | – | † | † |
| 129. *Limatula subauriculata* (Montagu) | 14 | 220 | – | – | – | – | † |
| 130. ***Limatula louiseae*** (n. sp.) | 9 | 1918 | – | (†) | – | – | – |
| 131. *Lima (Acesta) excavata* (Fabricius) | (23), (31) | (680) | – | – | (†) | – | (†) |
| Anomiidae | | | | | | | |
| 132. *Monia patelliformis* (L) | 17, (20) | 37–(55) | – | – | – | – | † |
| 133. *Anomia aculeata* Müller | 29 | 260 | – | – | † | – | – |
| 134. *Anomia ephippium* L | 16 | 86 | – | – | – | – | † |
| Astartidae | | | | | | | |
| 135. *Astarte borealis* (Schumacher) | 1054, 1056, 1057, (1058), 1059 | 25–312 | – | – | – | † | – |
| 136. *Astarte crenata* Gray | 13, (16), (20), 21, 29, (32), (35), (37), 1034, 1039, 1057, (1059), (1061), 1068, (1069) | (30)–240–489–(1210) | – | – | † | † | (†) |
| 137. *Astarte elliptica* Brown | (1069) | (30) | – | – | (†) | – | – |
| 138. *Astarte montagui* (Dillwyn) | 1054, 1057, 1059 | 25–260 | – | – | – | † | – |
| 139. *Astarte subaequilatera* (Sowerby) | 13, 14 | 220–240 | – | – | – | – | † |
| Thyasiridae | | | | | | | |
| 140. *Thyasira equalis* (Verrill & Bush) | 1033, 1034, 1036, 1059, (1060) | 209–1268 | – | – | – | † | – |
| 141. *Thyasira gouldi* Philippi | 40, 1039, 1057, 1058, 1059 | 208–314 | – | † | – | † | – |
| 142. *Axinulus eumyarius* (M. Sars) | 6 | 958 | – | † | – | – | – |
| 143. *Axinulus ferruginea* Winckworth | 13, 14 | 220–240 | – | – | – | – | † |
| 144. *Axinulus pygmaeus* (Verrill & Bush) | 1033, 1034 | 489–509 | – | – | – | (†) | – |
| 145. *Axinulus succisa* Jeffreys | 6 | 958 | – | † | – | – | – |
| 146. *Axinopsis orbiculata* G.O. Sars | (13), 1059 | 208–(240) | – | – | – | † | (†) |
| Erycinidae | | | | | | | |
| 147. *Kellia suborbicularis* (Montagu) | 17 | 37 | – | – | – | – | † |
| Cardiidae | | | | | | | |
| 148. *Serripes groenlandicus* (Gmelin) | (35), (1054) | (25)–(405) | – | – | (†) | (†) | – |

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| | | fm | | | | | |
| 149. *Clinocardium ciliatum* (Fabricius) | (1054) | (405) | – | – | – | (†) | – |
| 150. *Parvicardium ovale* (Sowerby) | (16), (20) | (55)–(86) | – | – | – | – | (†) |
| 151. *Parvicardium scabrum* (Philippi) | 13, 14, (16) | (86)–220–240 | – | – | – | – | † |
| 152. *Cerastoderma elegantulum* (Beck) | 1054 | 25 | – | – | – | † | – |
| Veneridae | | | | | | | |
| 153. *Venus casina* L. | 20 | 55 | – | – | – | – | † |
| 154. *Venus* (*Timoclea*) ovata Pennant | 14, 20 | 55–220 | – | – | – | – | † |
| Mactridae | | | | | | | |
| 155. *Spissula elliptica* (Brown) | 16, 17 | 37–86 | – | – | – | – | † |
| Psammobiidae | | | | | | | |
| 156. *Gari fervensis* (Gmelin) | 15 | 58 | – | – | – | – | † |
| 157. *Gari* (*Psammobella*) *tellinella* (Lamark) | 16, 20 | 55–86 | – | – | – | – | † |
| Semelidae | | | | | | | |
| 158. *Abra nitida* (Müller) | 14 | 220 | – | – | – | – | † |
| Tellinidae | | | | | | | |
| 159. *Macoma calcarea* (Gmelin) | 1053, (1054), 1055, 1056, (1069) | (25)–92–95 | – | – | (†) | † | – |
| 160. *Macoma loveni* (Jensen) | 1056, (1059) | 95–(208) | – | – | – | † | – |
| 161. *Macoma moesta* (Deshayes) | 1053, 1054, (1055), 1056 | 25–95 | – | – | – | † | – |
| Hiatellidae | | | | | | | |
| 162. *Hiatella arctica* (L) | 16, 17 (1052), 1053, 1054, (1055), 1056, 1069 | 30–95 | – | – | † | † | † |
| Myidae | | | | | | | |
| 163. *Mya truncata* (L) | (1052), 1054, (1069) | (0)–25–(30) | – | – | (†) | † | – |
| Thraciidae | | | | | | | |
| 164. *Thracia myopsis* "Beck" Møller | 1059 | 208 | – | – | – | † | – |
| Laternulidae | | | | | | | |
| 165. *Periploma abyssorum* Verrill | 1059 | 208 | – | – | – | † | – |
| Verticordiidae | | | | | | | |
| 166. *Lyonsiella abyssicola* M. Sars | 1033 | 509 | – | – | – | † | – |
| 167. *Lyonsiella* sp. | 1039 | 314 | – | – | – | † | – |

| Species | Stations | Minimum Depth-range | Off Grand Banks | Labrador Sea | Off S. Greenland | Baffin Bay | Off S. W. Iceland |
|---|---|---|---|---|---|---|---|
| | | fm | | | | | |
| 168. *Verticordia* sp. | 1069 | 30 | – | – | † | – | – |
| Poromyidae | | | | | | | |
| 169. *Cetoconcha nitida* (Verrill) | 775 | 775 | † | – | – | – | – |
| Cuspidariidae | | | | | | | |
| 170. *Cuspidaria exigua* Jeffreys | 23(?), 1034, 1062, 1065 | 360–1000 | – | – | – | (†) | (?) |
| 171. *Cuspidaria glacialis* G. O. Sars | 26, 40(?), 1033 | 215(?)–(509)–(620) | – | (?) | – | (†) | (†) |
| 172. *Cuspidaria lamellosa* (M. Sars) | 1039, 1068 | 295–314 | – | – | – | † | – |
| 173. *Cuspidaria pellucida* Stimpson | 1034, 1062 | 360–489 | – | – | – | (†) | – |
| 174. *Cuspidaria subtorta* (G.O. Sars) | 1057, 1059 | (208)–260 | – | – | – | (†) | – |

1. Numbers and symbols without parentheses represent living specimens:

   Numbers and symbols within parentheses represent empty shells:

   † indicates presence;

   – indicates absence or failure to detect presence:

   Symbols within circles indicate new regional records:

   ? indicates uncertain identification (usually juvenile specimens).

## Taxonomy

Most of the species collected during this survey have been discussed and illustrated in the relevant literature, for example, Sars 1878; Thorson 1941, 1944, 1951; Madsen 1949; Ockelmann 1958; Tebble 1966; Macpherson 1971; Lubinsky 1972. It is therefore unnecessary to discuss them all here. However, some of the species appear to be new, and others exhibit unusual morphological features or contribute to the solution of taxonomic problems. The following remarks pertain to such species.

### Lepidopleuridae

Smith (1960) has shown that *Stenosemus* Middendorff, 1847, is an available generic name, with *Chiton albus* Linnaeus as its type species. *Lophyrochiton* Yakovleva, 1952 (type, *C. albus* L.), is therefore an objective synonym, and the species called *Lophyrochiton albus* by recent authors is here cited as *Stenosemus albus*. The specimens of *S. albus* reported here were taken off southwestern Iceland in 86 fathoms and they show unusual variation. The four specimens form a series progressing from almost pure white with some brown mottling on the posterior valves to heavy chestnut with rust-red mottling on all valves (Figure 1).

### Patellidae

The single specimen of *Pilidium fulvum* is an empty shell but with adherent periostracum. It is of the rare white "variety".

### Trochidae

The *Solariella obscura* is an empty, half-grown specimen but is referable to "variety" *bella* Verkrüzen as illustrated by Odhner 1912.

### Trichotropidae

Six specimens of *Torellia* were collected alive off the Grand Banks in 775 fathoms. They are exceedingly variable in regard to periostracal "hair", but the extreme specimens are connected by intergrades (Figures 2, 3, and 4). One extreme is evenly covered with short, fine hair. This is much like the figures in Jeffreys (1867, Pl. 4, fig. 1) and Sars (1878, Pl. 22, figs. 1a, 1b) of *Torellia vestita* Jeffreys except that the spire is somewhat lower, as noted by Verrill (1882:521). The other extreme is densely covered with long, flat hairs arranged in ten spiral rows on the body whorl. This is undoubtedly the *T. fimbriata* of Verrill and Smith (Verrill 1882:520, Pl. 57, fig. 27). Some of the intermediate specimens also match Verrill's description of *Torellia fimbriata* var. *tiarella* (Verrill 1882:521). It is quite apparent that only one species is represented in our material, and the relatively smooth specimen is so much like the descriptions and figures of *T. vestita* that it undoubtedly is that species. Therefore, both *T. fimbriata* Verrill and Smith and var. *tiarella* Verrill must be regarded as synonyms of *T. vestita* Jeffreys at the species level. Whether or not a dis-

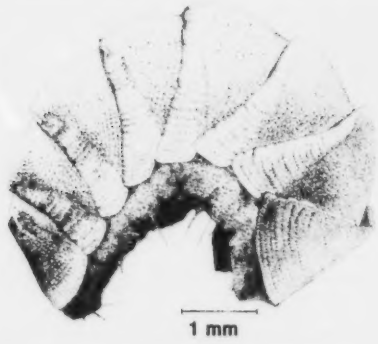


Figure 1
*Stenosemus albus* (L), Sta. 16

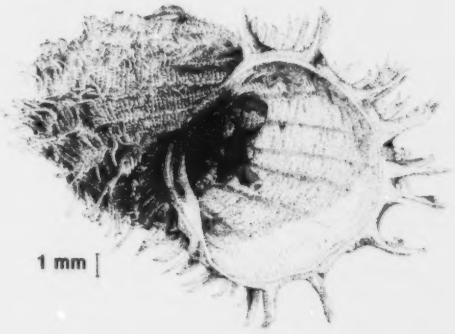


Figure 2
*Torellia vestita* Jeffreys, Sta. 775

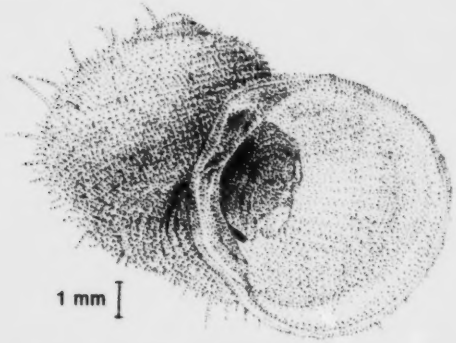


Figure 3
*Torellia vestita* Jeffreys, Sta. 775

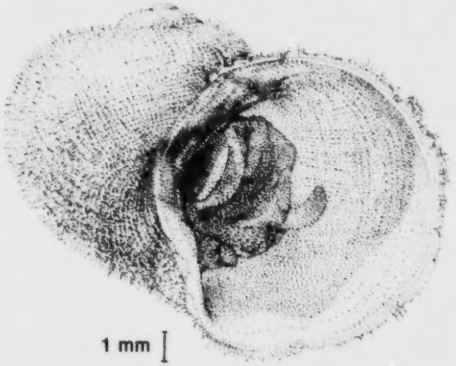


Figure 4
*Torellia vestita* Jeffreys, Sta. 775

crete North American subspecies exists must remain unknown until much more material can be acquired and studied.

**Naticidae**

The *Natica clausa* from Station 15 is unusual in that it is reddish-brown, with a distinct white band below the suture and white on the base. See Odhner 1913:14 for an extensive description of variation in *N. clausa*.

**Pyramidellidae**
***Melanella orphanensis,*** n. sp.
Figure 5

Description

Shell small (about 1/6 inch), turriculate, white, slightly bent, and with narrow axial riblets irregularly spaced on the early whorls. About nine whorls on holotype. Nuclear whorl deviated paucispiral. Early postnuclear whorls plano-convex, with a translucent band below the suture, a transparent band above the sutures, and with close but irregularly spaced white axial thickenings between the suprasutural and subsutural bands. Late postnuclear whorls predominantly flat but noticeably convex above sutures and with axial thickenings fewer but extending to both sutures. Sutures impressed. Body whorl with a poorly defined, low, subangular spiral peripheral band and a similar spiral band below it intersecting the top of the aperture. Spire narrow and slightly bent. Aperture small, prosocryt, orthocline, mostly basal, angular above, sharply convex below; outer lip narrow and evenly curved; inner lip thickened and intersecting the columella within the aperture. Umbilicus absent. No operculum seen.
Holotype: height, 4.2 mm; width, 1.3 mm; number of whorls, 9.

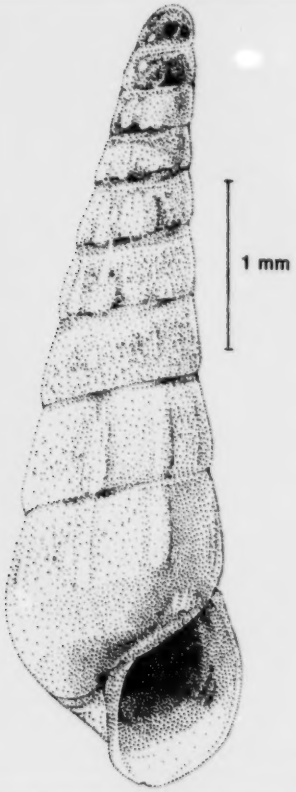


Figure 5
***Melanella orphanensis*** (n. sp.), holotype, Sta. 6

Figure 6
*Pyramidella* sp., Sta. 6

## Types

Only the holotype is known and this is an empty shell in fine condition except for a small chip near the base of the outer lip. The specimen was dredged in the Labrador Sea on Orphan Knoll at Station 6 (50°32.9'N, 46°22.0'W, 961 fm) by Mr. Brian T. Kidd on 23 May 1971. It bears catalogue number 66345 and is in the National Museum of Natural Sciences, Ottawa.

## Remarks

I cannot locate any other species that has the bent spire and ribbed axial sculpturing of ***M. orphanensis***. Nothing like it has been seen in museum collections in eastern North America or in the literature. The bent spire is characteristic of *Melanella* but, with the exception of growth lines, none of the species known to me possess axial sculpturing. The axial sculpturing is quite distinctive, and the holotype therefore appears not to be a deformed specimen of any species that is normally not bent. The species may deserve separate supraspecific status but more material should be available before that decision is made.

A single *Pyramidella* was also taken at Station 6. The specimen was dead, somewhat worn, and its aperture was occupied by a sipunculid worm tube. The mollusc apparently belongs to an undescribed species but its condition is not good enough to provide a suitable basis for description of a new species. The specimen, with the sipunculid tube removed, is shown in Figure 6.

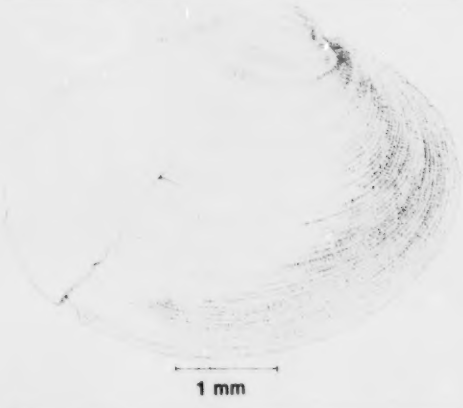


Figure 7
*Tindaria* sp., Sta. 23

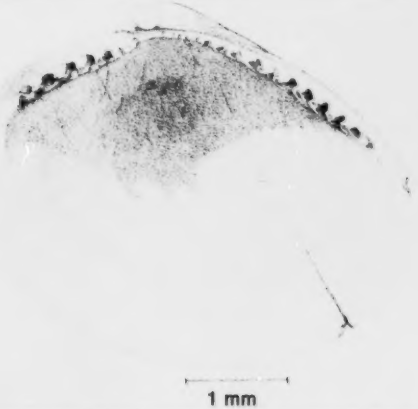


Figure 8
*Tindaria* sp., Sta. 23

**Malletiidae**

A single valve of *Tindaria* was taken at Station 23 (61°36.6′N. 28°25.7′W, 600–700 fm) on the Reykjanes Ridge using a rock dredge. It also appears to be an undescribed species but is too incomplete to describe. The specimen is illustrated in Figures 7 and 8.

**Limidae**
***Limatula louiseae,*** n. sp.
Figure 9

Description

Shell minute (about 1/10 inch long), similar in shape to other species of *Limatula,* inflated, thin, fragile, translucent and concentrically ribbed. Sculpture consists of about 30 sharp, narrow, concentric ribs, a few of which are wider than the others and are lamellate; poorly defined whitish, radial streaks across the central portion of the valves; and fine whitish lines on the anterior and posterior slopes approximately perpendicular to the hinge line and diagonally intersecting the concentric ribs. Umbones rounded, projecting beyond the hinge, and with centrally worn apices apparently caused by mutual abrasion when the valves are opened. Auricles short and equal. Hinge straight, with ligament pit shallow, centrally located, V-shaped above, rounded below, and projecting below the hinge line. Interior whitish, with external ribs and lines clearly visible.
Holotype: length, 2.3 mm; width, 1.6 mm; inflation (valves appressed), 1.6 mm.

Figure 9
***Limatula louiseae*** (n. sp.), holotype, Sta. 9

## Types

The holotype, a living specimen, was dredged by Mr. Brian T. Kidd on board U.S.S. *Lynch* at Station 9 (51°06.6′N, 37°47.3′W, 1,918 fm) in the Labrador Sea not far from the western foothills of the Mid-Atlantic Ridge. It is in the Mollusc Unit, National Museum of Natural Sciences, Ottawa, and bears catalogue number 66418. ***Limatula louiseae*** is named in fond memory of the late Louise Robinson Clarke, my good wife and dear friend, for 25 years.

## Remarks

This small *Limatula* differs from *L. elliptica* (Jeffreys), *L. subauriculata* (Montagu), *L. subovata* (Jeffreys) and all other northern species seen, in that its dominant sculpturing is concentric and not radial. The species cited, and other species, also exhibit concentric lines but none have the prominent lamellate cords of ***L. louiseae***. It is closer to *Limatula laminifera* (Smith) than to any other known species, but it is more equilateral and has microscopic lines on the anterior and posterior slopes diagonal to the lamellae, a feature that apparently (Stuardo 1968) does not occur in *L. laminifera*. In addition, *L. laminifera* is from mid-archibenthal depths in the West Indies. Thus, on zoogeographic grounds alone it is unlikely that the two populations represent the same species.

***Limatula louiseae*** was found in somewhat deeper water than the deepest previous record for a *Limatula*, that is, *L. subauriculata* in 1,785 fm (Clarke 1962). It may be an immature specimen but, if so, appears to be quite different from the young stages of any other North Atlantic species.

Figure 10
*Lyonsiella* sp., Sta. 1039

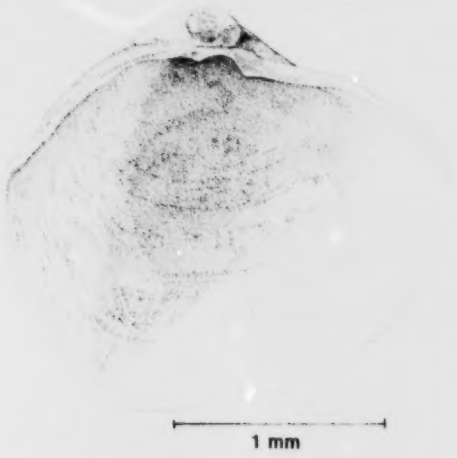


Figure 11
*Lyonsiella* sp., Sta. 1039

**Verticordiidae**

Two small living specimens of *Lyonsiella* were found at Station 1039 (66°10.5'N, 57°33.6'W, 314 fm) on the saddle of the Davis Strait Sill. They do not appear to belong to any known species, but since they are apparently quite immature their identity cannot be established with certainty. (Figures 10 and 11).

Several of the species found represent substantial range extensions. These species with the exception of those which have already been discussed or have not been confidently identified, are listed below.

*Pilidium fulvum* (Müller) occurred as a fresh, empty shell off southern Greenland in 550–650 fm. The species is recorded from Iceland and farther east (Thorson 1941) but not from the North Atlantic west of Iceland.

*Calliostoma occidentale* (Mighels and Adams) was found alive off southern Greenland in one dredge haul taken in 220–400 fm. It was previously known only from North America (off Sable Island, Nova Scotia, to off New Jersey) and Europe (northern Norway to Scotland) (Clench and Turner 1960).

*Cerithiella metula* (Lovén) was taken alive in Davis Strait and the Labrador Sea and as empty shells off southern Greenland and southwestern Iceland. The species was known previously only from Iceland eastward (Thorson 1941).

*Laeocochlis granosa* (Wood) occurred off the Grand Banks (empty but fresh-looking), in Davis Strait (alive and dead), and off southern Greenland (dead but fresh). Sars (1878) recorded it only from the Norwegian Sea, but Thorson (1941) later recorded it from West Greenland (alive) and Iceland (shells). It has not been recorded previously from off the coast of North America.

*Acirsa costulata* (Mighels and Adams) was found, as empty shells, in the Labrador Sea and off southwestern Iceland. It was previously known only from West Greenland and the coast of North America south to Massachusetts (Clench and Turner 1950).

*Epitonium obtusicostatum* (Sars) was taken, shells only, on the Reykjanes Ridge southwest of Iceland and off southern Greenland. Thorson (1941) recorded empty shells from Iceland and Norway (no living specimens) but not west of Iceland.

*Aclis walleri* Jeffreys was collected empty from the Reykjanes Ridge off southwestern Iceland. It is recorded from off Norway (Thorson 1941) and from the Labrador Sea (Thorson 1951) but not Iceland.

*Neptunea satura* (Martyn) was found alive and as empty shells off southwestern Iceland. The species is not listed from Iceland by Thorson (1941). Golikov (1963) gives the range of *N. satura* as extending from the coast of Yukon Territory to southern Alaska and Kamchatka and across the arctic coast of Eurasia to Finland and Spitzbergen. The Iceland records apparently represent the farthest extension into the North Atlantic that this species has so far achieved.

*Eulimella compactilis* Jeffreys was collected alive from two localities in the central part of Davis Strait. Thorson (1944) records this species in the North Atlantic only near or south of Lofoten Is., Norway.

*Ledella confinis* (Smith) was found, as empty shells, at two localities in the Labrador Sea in 958 and 2,354 fm. It was known previously only from the Mid-Atlantic Ridge and the Canaries Basin in depths of 410–1,150 fm (Clarke 1962).

*Arca nodulosa* Müller occurred alive southwest of Iceland and near Cape Farewell, Greenland. It has not previously been recorded west of Iceland (Madsen 1949).

*Cyclopecten abyssorum* (Lovén) was found living in 314 fm in Davis Strait. Previous records are all from the eastern Atlantic from the Norway Basin south to the Cape Verde Basin (Clarke 1962).

*Chlamys septemradiatus* (Müller) was found as empty shells southwest of Iceland (including a locality on the Reykjanes Ridge) and near Cape Farewell, Greenland. It was recorded by Madsen (1949) only from Iceland and eastward to the coast of Europe.

*Axinulus pygmaeus* (Verrill & Bush) was found abundantly at two localities in northwestern Baffin Bay at 489 and 509 fm. It was known previously only from the North American Basin and near Iceland (Ockelmann 1958).

*Cuspidaria exigua* Jeffreys was found alive in three dredge hauls from northwestern and east-central Baffin Bay and occurred empty (identification uncertain) southwest of Iceland. It has been recorded only as empty shells from the vicinity of Jan Mayen, Spitzbergen, and Norway (Ockelmann 1958).

*Cuspidaria pellucida* Stimpson occurred alive at two localities in northwest and east-central Baffin Bay in 360 and 489 fm. Ockelmann (1958) records it only from off North America between Newfoundland and Cape Cod.

*Cuspidaria subtorta* (G.O. Sars) was collected alive at one locality and empty at another, both in northern Baffin Bay. It was previously recorded doubtfully from West Greenland and the coast of North America between Newfoundland and Cape Cod, and recorded positively from East Greenland eastward to off the coast of Europe (Ockelmann 1958).

Some other species are recorded here from localities in Baffin Bay that are significantly farther north than those previously known. The most extreme examples are *Oenopota reticulata* (Brown), previously known (doubtfully) from near Frobisher Bay (Macpherson 1971) and now recorded 600 miles to the north, and *Megayoldia thraciaeformis* (Störer), known previously as far north as Upernavik, Greenland (Thorson 1951), and here recorded from localities 300 miles farther to the north.

At first sight the molluscan fauna dredged near Iceland appeared quite different from those dredged in Baffin Bay and along the coast of North America. Further examination showed the presence of several genera and species that do not occur in the western Atlantic, for example, *Emarginula fissura, Aporrhais serresiana, Nassarius incrassatus, Arca nodulosa, Modiolus phaseolinus, Chlamys septemradiatus, Hinnites distorta, Parvicardium* spp., *Venus casina, Gari* spp., etc. Immediate questions arose, such as, where does the transition zone occur between the European and North American fauna;[1] how complete is that transition; and if a well-defined zoogeographic boundary does exist along the northern North Atlantic island arc, what biological, historical and oceanographic features maintain it?

Analysis of the available distributional data on northern prosobranch gastropods (Thorson 1944: 146–54) and northern lamellibranchs (Ockelmann 1958: 194–201), with additions from the present survey and other data, substantiates the casual observation that a well-defined transition zone exists between Iceland and eastern Greenland. If the 79 pan-boreal Atlantic prosobranch species and the 70 pan-boreal Atlantic lamellibranch species (which occur from North America to Europe and along the whole Greenland–Iceland–Faroes island arc) are set aside, and the few species endemic to a particular segment of the arc are likewise excluded, a substantial residue of North American species and European species remains. Not surprisingly, these species groups are represented by decreasing numbers of species with the increasing distance from North America and Europe (Table 4).

The faunal changes that occur may be expressed in a striking manner by noting the percentage of European species relative to the total of European plus North American species in the faunas of West Greenland, East Greenland, Iceland and the Faroes. These percentages are 22, 41, 88 and 100 respectively. The most dramatic shift occurs as one progresses from East Greenland to Iceland, and is caused principally by the large increase (78) of European species and only secondarily by a decrease (16) in North American species. On zoogeographic grounds, therefore, the island arc may be considered as a region of transition between the North American and European faunas; if it is desirable to apply a boundary line between these zoogeographic regions, the line should be located between East Greenland and Iceland. This problem should be expanded and investigated more thoroughly to determine whether or not corresponding zoogeographic boundaries may be defined for regions of greater depth. The whole problem of zoogeographic limits of the deep sea benthos is a particularly intriguing one.

1 I believe that such adjectives as "arctic", "subarctic", "boreal", and "European" have been applied much too extensively in the literature on marine molluscs. Pseudo-problems arise when one attempts to explain the presence of a species in the Arctic, for example, that has been assigned previously to a subarctic species group. In the present context, "European" and "North American" are used to characterize species whose distributions extend beyond the Greenland–Iceland–Faroes arc to Europe or to North America. The terms are meant to imply nothing about species origins or about their migration routes, and no problems therefore arise through their use.

Table 4
Species representation of geographic faunal groups of marine prosobranchs and lamellibranchs occurring near West Greenland, East Greenland, Iceland, and the Faroe Islands

| Species Group | West Greenland | East Greenland | Iceland | Faroe Islands |
|---|---|---|---|---|
| North American prosobranchs | 27 | 22 | 10 | 0 |
| North American lamellibranchs | 16 | 8 | 4 | 0 |
| European prosobranchs | 5 | 10 | 44 | 56 |
| European lamellibranchs | 7 | 11 | 55 | 73 |
| Per cent North American* | 21 | 15 | 5 | 0 |
| Per cent European | 6 | 10 | 38 | 46 |
| Per cent pan-boreal Atlantic | 73 | 75 | 57 | 54 |

*Prosobranchs and lamellibranchs only and excluding localized endemic species.

It is usually difficult, and often impossible, to decide whether new regional records for species are the results of more thorough and effective collecting methods or if they signify migrations of the species concerned. When large or conspicuous species are found in areas that have been well studied by previous investigators, it is probable that faunal migrations have occurred. Present examples are the new records of *Laeocochlis granosa* from near the Grand Banks, *Neptunea satura* from near Iceland, and *Megayoldia thraciaeformis* from the northern extremity of Baffin Bay. On the other hand, new records of small and inconspicuous species may not reflect faunal migrations, although the possibility of such migrations surely exists. Examples here are the new records of *Aclis walleri, Eulimella compactilis* and *Axinulus pygmaeus*.

Natural range expansions of some marine animals are well documented, and there is every reason to believe that the zoogeography of archibenthal and abyssal molluscs is also dynamic. Our present concepts of geographic distribution patterns of deep-water marine molluscs are based on summations of all presumably authentic species records accumulated over 50 to 100 years or more. The extent to which these conceptual patterns reflect present reality is an important question that deserves extensive investigation.

Some aspects of the composition and relationships of the Baffin Bay molluscan fauna have been discussed previously (Thorson 1951; Clarke 1963). The material now available shows that the Baffin Bay fauna is substantially an extension of the Labrador Sea fauna but that it contains fewer species. The presence of some endemic mollusc species occurring in depths greater than 300 fm, that is greater than the sill depth of Davis Strait, suggests substantial antiquity of isolation of that fauna. These species are *Acrybia glacialis* Thorson, *Colus krampi* (Thorson), and some other species reported here that may be new, that is, *Proneomenia* sp., *Chaetoderma* sp. and *Lyonsiella* sp. Presumed antiquity is in agreement with the most recent estimates of age for the termination of sea-floor spreading in Baffin Bay and the formation of the Davis Strait Sill, that is, about 60 million years ago (Keen et al. 1972; see also Hyndman 1973).

Based on estimates of evolutionary rates derived from studies of other regions, the relative extent of endemicity in Baffin Bay is lower than might be expected. Evolution may well be slower in cold than in warm regions, however, because as indicated by other evidence (Dobzhansky 1950, general; Clarke 1965, molluscs), selection in cold regions is primarily physical, whereas in warm regions it is primarily biological. Additional geophysical studies in Baffin Bay may well provide a new basis for estimating probable evolutionary rates in an arctic marine environment.

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